

Claims

1. In a GM, Solvay, or GM type pulse tube refrigerator a valve assembly comprising at least a valve disc and at least a valve seat and at least a thrust bearing
5 in which one of the face of the valve disc and the face of valve seat is in contact with the face of the thrust bearing.
2. A valve assembly in accordance with claim 1 in which the thrust bearing is attached to the valve seat and the face of the valve disc is in contact with the face
10 of the thrust bearing.
3. A valve assembly in accordance with claim 1 in which the thrust bearing is attached to the valve disc and the face of the valve seat is in contact with the face of the thrust bearing.
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4. A valve assembly in accordance with claim 1 in which the thrust bearing is fixed by a fixture.
5. In a GM, Solvay, or GM type pulse tube refrigerator a valve assembly
20 comprising at least a valve disc and at least a valve seat and at least a thrust bearing in which initially the face of the valve disc and the face of valve seat are in contact with each other.
6. A valve assembly in accordance with claim 5 in which the thrust bearing is
25 attached to the valve seat.
7. A valve assembly in accordance with claim 5 in which the thrust bearing is attached to the valve disc.
- 30 8. A valve assembly in accordance with claim 5 in which at least one of the valve seat and the valve disc are in contact with the face of the thrust bearing and the thrust bearing is fixed by a fixture.

9. A low torque, reduced wear rotary valve unit comprising a valve disc, valve seat and a thrust bearing wherein the thrust bearing supports the rotating valve disc relative to the valve seat such that the gap between them varies from light contact to a very small gap.

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10. The valve unit of claim 9 where the face of the valve seat and the face of the valve disc are separated from each other by a distance of up to 25 μm .

11. A low torque, reduced wear rotary valve unit comprising a valve disc, valve
10 seat and a thrust bearing wherein the force typically exerted on the face of the valve seat is transferred to the face of the thrust bearing.

12. A method of reducing the torque required to turn a multiple port rotary disc
valve by limiting the friction force between the valve disc and the valve seat
15 comprising interposing a thrust bearing to support the rotating valve disc.